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ED42/John Kaufman

(NASA-CR-171337) CYCLONE DIAGNOSTICS  
Quarterly Progress Report, 1 Aug. - 31 Oct.  
1984 (Universities Space Research  
Association) 11 p HC A02/EF A01 CSCI 04B

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## QUARTERLY PROGRESS REPORT

RESEARCH STUDY:  
CYCLONE DIAGNOSTICS

CONTRACT NAS 8-34010

REPORTING PERIOD: AUG 1, 1984 -- OCT 31, 1984

PREPARED FOR:  
THE GEORGE C. MARSHALL SPACE FLIGHT CENTER  
MARSHALL SPACE FLIGHT CENTER  
ALABAMA 35812

USRA P. O. Box 3006, BOULDER, CO 80307

PROGRESS REPORT:      CONTRACT NAS8-34010  
Research Study:      Cyclone Diagnostics  
Period:              August 1, 1984 -- October 31, 1984

During the reporting period, Dr. Franklin Robertson and Dr. Jeffry Rothermel continued as Visiting Scientists under this contract. Their progress reports for the period are attached.

Dr. C. M. Tang continued in his capacity of Research Specialist. A copy of Dr. Tang's report is attached.

In August, Mr. Richard Doviak traveled to France to present a paper. A copy of his foreign trip report is attached.

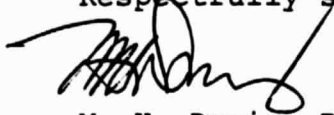
A number of Research Specialists assisted with various facets of the NASA CV 990 Doppler Lidar flight program held at NASA/Ames Research Center in August and September. Dr. Carl Friehe was the scientist-in-charge for planning the flight pattern for the ocean boundary layer study. Drs. Luke Gilchrist, William Blumen and Jeffry Rothermel also provided support for the flights.

In September, Mr. Richard Thompson assisted with installation and operation of equipment aboard the CV 990 on flights over the test area in Perma. Mr. Carl Chelius assisted in conjunction with radar. His report is attached.

In October, Dr. Albert Barcilon traveled to MSFC to deliver a seminar on Atmospheric Vacillation and to have discussions with Dr. Dan Fitzjarrald.

At the present time, there are no problems to impede progress on this contract.

Respectfully submitted,



M. H. Davis, Ph.D.  
Program Director for  
Atmospheric Processes

Distribution:

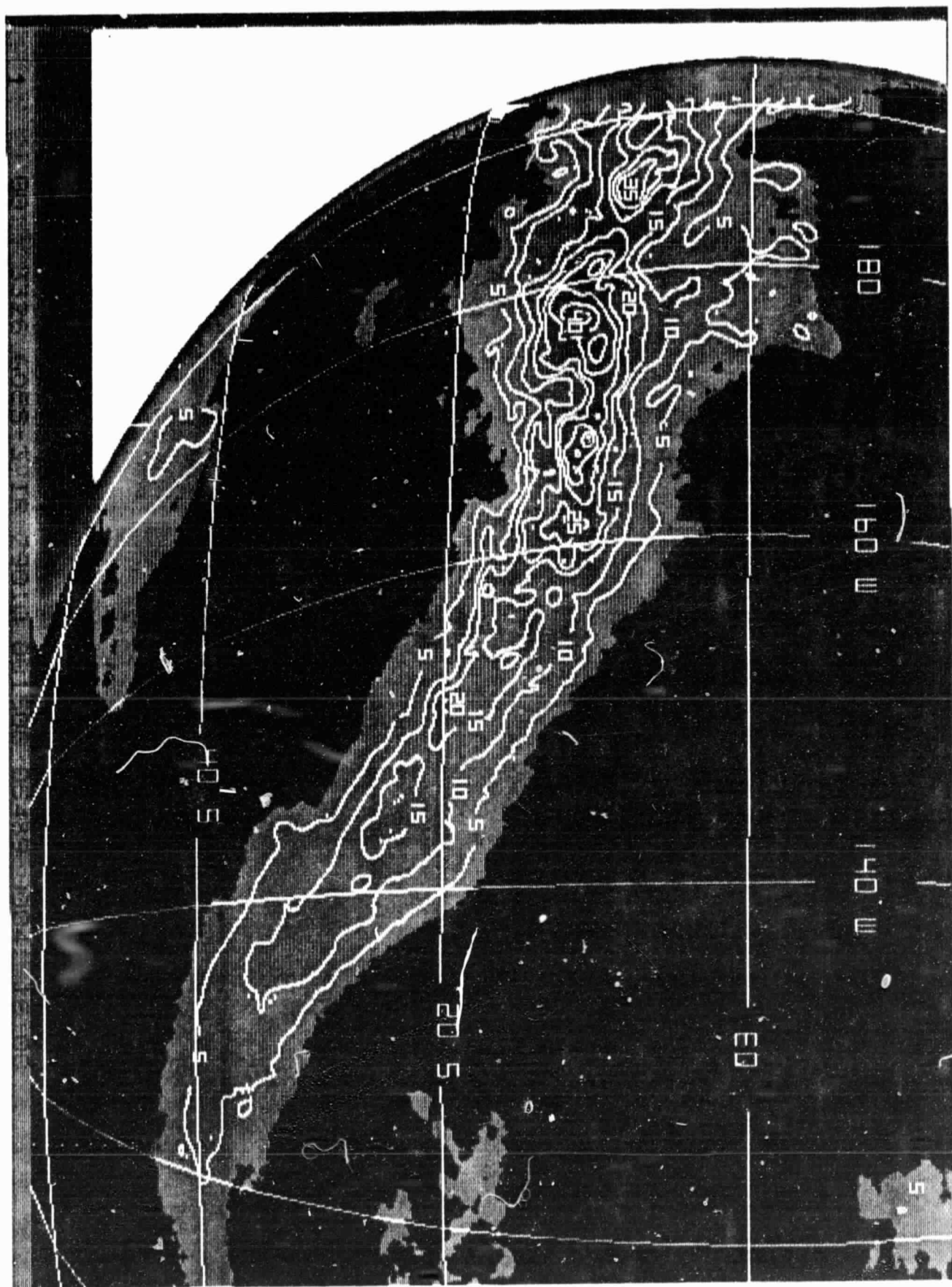
AP29-F	1
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PROGRESS REPORT: Dr. Franklin Robertson  
PERIOD: August 1, 1984 -- October 31, 1984  
CONTRACT: NAS8-34010

The GOES IR rainfall estimation algorithm has been completed with verification tests now accomplished over the GATE B-Scale array, coastal North Carolina during winter storms and at rainguage locations in the South Pacific during FGGE SOP-1. While the algorithm performance is better for tropical convective regions (correlation of .85 with 12h means of GATE radar rainfall), considerable skill in extratropical cyclone precipitation also exists (correlation of .70 with rainguage amounts). When applied to the South Pacific, the total estimated rainfall summed over 26 stations for six days was within 10% of guage amounts. A paper describing the technique is in preparation and will be submitted to JCAM in January 1985.

Application of the technique to the South Pacific Convergence Zone (SPCZ) during FGGE SOP-1 has been started this quarter. A map of six-day mean rainfall rate estimated by the method is shown in the accompanying figure.

Significant progress was also made in defining strawman Space Shuttle/Spacelab Atmospheric Science Experiment (SASE) complements that would be possible components of NASA's Earth Observation Mission series. The science objectives and suggested strawman complement of visible, infrared and microwave sensors was presented in October to Mr. John Theon, Chief, Atmospheric Radiation and Dynamics Branch, NASA Headquarters. The concept is currently under review.



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GOES IR Estimated Precipitation Jan 10-16 1979  $10^{-1} \text{ mmh}^{-1}$

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PROGRESS REPORT: Dr. Jeffry Rothermel  
PERIOD: August 1, 1984 -- October 31, 1984  
CONTRACT: NAS8-34010

A revised paper submitted to the Journal of Atmospheric and Oceanic Technology has been accepted and it should appear early next year. The paper summarizes dual-Doppler lidar analyses and a radar-lidar comparison using data collected during the participation of the MSFC 10.6 micron coherent lidar in JAWS.

Preliminary analysis of vertical profiles of calculated backscatter and attenuation using the MSFC 10.6 micron coherent lidar is revealing fluctuations on a variety of spatial and temporal scales. Similar profiles exist for pulse length of 320 meters, which generally extend to lesser heights but reveal finer vertical structure. Thus far, resulting time series of backscatter as a function of height (using 320 meter pulse length) have been assembled for each standard level at which calculations were made. The time series reveals the expected seasonal variation, with maximum and minimum in the summer and winter months, respectively. Variations in attenuation are found to positively correlate with those in backscatter.

Analysis of the remainder of the data set will continue. Additionally, examination will be made of the backscatter



Dr. Jeffry Rothermel  
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measurements made during the JAWS experiment. The first of a two-part series of papers describing the analysis technique and results is nearly completed. Both papers are to be submitted to Applied Optics.

PROGRESS REPORT: Dr. Chung-Muh Tang

PERIOD: August 1, 1984 -- October 31, 1984

CONTRACT: NAS8-34010

1. I have derived the formulas for the second-order eddy specific humidity field for the moist model with upper-level moisture and have checked these formulas.
2. The paper, "Non-quasi-geostrophic effects in baroclinic waves with latent heat release," by Chung-Muh Tang and George H. Fichtl, has been published in the Journal of the Atmospheric Sciences 41, 1498-1512.
3. I have submitted the abstract of the paper, "The effect of finite-amplitude baroclinic waves on passive, low-level, atmospheric constituents, with applications to comma cloud evolution," to Prof. William Blumen for the consideration as a paper to be presented at the Fifth Conference on Atmospheric and Oceanic Waves and Stability, American Meteorological Society, March 4-7, 1985, New Orleans, LA. This paper is coauthored with Prof. Barry Saltzman. I have corrected the proof of this paper which will be published in Tellus in the future.
4. I have begun to study the system dynamics equations of the baroclinic-barotropic model with bottom topography, heating and dissipation. For the steady state, the formulas for the wave amplitudes were expressed in terms of the forcing parameters and the zonal mean wind with baroclinicity. From these I obtained two expressions, one of which was quartic in baroclinicity. The barotropic case of this system was studied next; I obtained two cubic equations, one for the equilibrium solution and the other for the perturbed state. When the mountain amplitude was set to zero, Rossby's formula with dissipation was obtained.

ACTIVITY REPORT: Dr. Carl R. Chelius

CONTRACT: NAS8-34010

Period: August 1, 1984 -- October 31, 1984

1. Preflight planning and consulting with D. W. Thomson and C. W. Fairall concerning the planned mission, possible flight paths, length of legs, Air Route Traffic Control problems and calculation of course and distances for several situations - i.e. "Dry Runs".
2. Forecast support during the time of the radar operation as well as during the flight window. During this period, at least twice daily forecasts were made for Dan Fitzjarrald.
3. Post-experiment data collection and archiving. Gathered Rawinsonde soundings from surrounding stations (Buffalo, NY; Albany, NY; Atlantic City, NJ; Dulles, VA; Huntington, W. VA; Pittsburgh, PA; and Dayton Ohio). Upper air maps for the 850, 700, 500, 300, and 200 mb levels were collected for each of the days the radar was running (from 00Z 14 September 1984 through 00Z 19 September 1984).

Preliminary analysis of the combined radar and flight data indicates that experimental results will have been severely impacted by flight priorities set beyond our control. For instance, on Sunday 16 September the winds were much better for the radar study purposes than either of the mission days allotted us ( 17 and 18 September). During the days the aircraft was flown for our mission, the winds were so light and variable that the winds produced by the aircraft's inertial navigation system are of apparently marginal quality and will require substantial processing effort.



**U.S. DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
**ENVIRONMENTAL RESEARCH LABORATORIES**  
**National Severe Storms Laboratory**  
**1313 Halley Circle**  
**Norman, OK 73069**

September 24, 1984

**SUMMARY FOREIGN TRIP REPORT**

From: Richard J. Doviak, Chief, Doppler Radar and Storm Electricity  
Research Group, National Severe Storms Laboratory, NOAA

Locations Visited: Aix en Provence, France; Firenze, Italy; Zurich,  
Switzerland

Purpose of Trip:

I presented and/or defended the following reports:

1. "Boundary layer winds, waves, and turbulence observed with airborne Doppler lidar and ground-based dual Doppler radars", 12th International Laser Radar Conference, Aix en Provence, France, 14-17 August.
2. "Atmospheric measurements", (Review of Israel URSI Meeting, May 1984, on Frontiers of Remote Sensing of the Oceans and Troposphere from Air and Space Platforms); XX1st General Assembly of the International Union of Radio Science (URSI), Firenze, Italy, 28 August - 5 September.
3. "Siting of Doppler weather radars to shield ground targets"  
and
4. "Doppler velocity bias due to beam blockage by ground targets", 22nd Conference on Radar Meteorology, Zurich, Switzerland, 10-14 September.

NOTE: Partial support from USRA.

